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<120> Attenuated Respiratory Syncytial Viruses

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<151> 1997-09-19

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Thr Ile Thr Gln Ser Leu Ile Ser Arg Tyr His Lys Gly Glu Leu Lys
      65           70           75           80

Leu Glu Glu Pro Thr Tyr Phe Gln Ser Leu Leu Met Thr Tyr Lys Ser
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Met Ser Ser Ser Glu Gln Ile Ala Thr Thr Asn Leu Leu Lys Lys Ile
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Ile Arg Arg Ala Ile Glu Ile Ser Asp Val Lys Val Tyr Ala Ile Leu
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Leu Met Cys Ser Met Gln His Pro Pro Ser Trp Leu Ile His Trp Phe
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Ser Tyr Leu Phe Asn Gly Pro Tyr Leu Lys Asn Asp Tyr Thr Asn Leu
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Ile Ser Arg Gln Ser Pro Leu Leu Glu His Met Asn Leu Lys Lys Leu
      50             55             60

Thr Ile Thr Gln Ser Leu Ile Ser Arg Tyr His Lys Gly Glu Leu Lys
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Leu Glu Glu Pro Thr Tyr Phe Gln Ser Leu Leu Met Thr Tyr Lys Ser
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Met Ser Ser Ser Glu Gln Ile Ala Thr Thr Asn Leu Leu Lys Lys Ile
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Ile Arg Arg Ala Ile Glu Ile Ser Asp Val Lys Val Tyr Ala Ile Leu
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Asn Lys Leu Gly Leu Lys Glu Lys Asp Arg Val Lys Pro Asn Asn Asn
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Ser Gly Asp Glu Asn Ser Val Leu Thr Thr Ile Ile Lys Asp Asp Ile
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Leu Ser Ala Val Glu Asn Asn Gln Ser Tyr Thr Asn Ser Asp Lys Ser
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His Ser Val Asn Gln Asn Ile Thr Ile Lys Thr Thr Leu Leu Lys Lys
      180            185            190

Leu Met Cys Ser Met Gln His Pro Pro Ser Trp Leu Ile His Trp Phe
      195            200            205

Asn Leu Tyr Thr Lys Leu Asn Asn Ile Leu Thr Gln Tyr Arg Ser Asn
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Glu Val Lys Ser His Gly Phe Ile Leu Ile Asp Asn Gln Thr Leu Ser

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 Gly Leu Lys Lys Ile Thr Thr Thr Thr Tyr Asn Gln Phe Leu Thr Trp
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 Lys Asp Ile Ser Leu Ser Arg Leu Asn Val Cys Leu Ile Thr Trp Ile
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 Ser Asn Cys Leu Asn Thr Leu Asn Lys Ser Leu Gly Leu Arg Cys Gly
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 Phe Asn Asn Val Val Leu Ser Gln Leu Phe Leu Tyr Gly Asp Cys Ile
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 Pro Thr Leu Arg Asn Ala Ile Val Leu Pro Leu Arg Trp Leu Asn Tyr

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 Asp Glu Leu His Gly Val Gln Ser Leu Phe Ser Trp Leu His Leu Thr
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 Ile Pro Leu Val Thr Ile Ile Cys Thr Tyr Arg His Ala Pro Pro Phe

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Lys	Phe	Ser	Ile	Thr	Ala	Leu	Ile	Asn	Gly	Asp	Asn	Gln	Ser	Ile	Asp				
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Pro	Ala	Ser	Ile	Lys	Lys	Val	Leu	Arg	Val	Gly	Pro	Trp	Ile	Asn	Thr				
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Gln	Glu	Leu	Glu	Tyr	Arg	Gly	Glu	Ser	Leu	Leu	Cys	Ser	Leu	Ile	Phe				
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Thr Cys Val Ile Thr Phe Asp Lys Asn Pro Asn Ala Glu Phe Val Thr 1045	1050	1055
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Thr Ser Glu Ile Asn Arg Leu Ala Val Thr Glu Val Leu Ser Ile Ala 1075	1080	1085
Pro Asn Lys Ile Phe Ser Lys Ser Ala Gln His Tyr Thr Thr Thr Glu 1090	1095	1100
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Tyr His Phe Asp Thr Ser Pro Ile Asn His Val Leu Thr Glu Lys Tyr		
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Leu Glu Glu Pro Thr Tyr Phe Gln Ser Leu Leu Met Thr Tyr Lys Ser
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Thr Ile Thr Gln Ser Leu Ile Ser Arg Tyr His Lys Gly Glu Leu Lys
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<211> 2166

<212> PRT

<213> respiratory syncytial virus

<400> 12

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Ser Tyr Leu Phe Asn Gly Pro Tyr Leu Lys Asn Asp Tyr Thr Asn Leu
 35 40 45

Ile Ser Arg Gln Ser Pro Leu Leu Glu His Met Asn Leu Lys Lys Leu
 50 55 60

Thr Ile Thr Gln Ser Leu Ile Ser Arg Tyr His Lys Gly Glu Leu Lys
 65 70 75 80

Leu Glu Glu Pro Thr Tyr Phe Gln Ser Leu Leu Met Thr Tyr Lys Ser
 85 90 95

Met Ser Ser Ser Glu Gln Ile Ala Thr Thr Asn Leu Leu Lys Lys Ile
 100 105 110

Ile Arg Arg Ala Ile Glu Ile Ser Asp Val Lys Val Tyr Ala Ile Leu
 115 120 125

Asn Lys Leu Gly Leu Lys Glu Lys Asp Arg Val Lys Pro Asn Asn Asn
 130 135 140

Ser Gly Asp Glu Asn Ser Val Leu Thr Thr Ile Ile Lys Asp Asp Ile
 145 150 155 160

Leu Ser Ala Val Glu Asn Asn Gln Ser Tyr Thr Asn Ser Asp Lys Ser

165

170

175

His Ser Val Asn Gln Asn Ile Thr Ile Lys Thr Thr Leu Leu Lys Lys
 180 185 190

Leu Met Cys Ser Met Gln His Pro Pro Ser Trp Leu Ile His Trp Phe
 195 200 205

Asn Leu Tyr Thr Lys Leu Asn Asn Ile Leu Thr Gln Tyr Arg Ser Asn
 210 215 220

Glu Val Lys Ser His Gly Phe Ile Leu Ile Asp Asn Gln Thr Leu Ser
 225 230 235 240

Gly Phe Gln Phe Ile Leu Asn Gln Tyr Gly Cys Ile Val Tyr His Lys
 245 250 255

Gly Leu Lys Lys Ile Thr Thr Thr Thr Tyr Asn Gln Phe Leu Thr Trp
 260 265 270

Lys Asp Ile Ser Leu Ser Arg Leu Asn Val Cys Leu Ile Thr Trp Ile
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Ser Asn Cys Leu Asn Thr Leu Asn Lys Ser Leu Gly Leu Arg Cys Gly
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Phe Asn Asn Val Val Leu Ser Gln Leu Phe Leu Tyr Gly Asp Cys Ile
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Leu Lys Leu Phe His Asn Glu Gly Phe Tyr Ile Ile Lys Glu Val Glu
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Gly Phe Ile Met Ser Leu Ile Leu Asn Ile Thr Glu Glu Asp Gln Phe
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Arg Lys Arg Phe Tyr Asn Ser Met Leu Asn Asn Ile Thr Asp Ala Ala
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Ile Lys Ala Gln Lys Asp Leu Leu Ser Arg Val Cys His Thr Leu Leu
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Asp Lys Thr Val Ser Asp Asn Ile Ile Asn Gly Lys Trp Ile Ile Leu
 385 390 395 400

Leu Ser Lys Phe Leu Lys Leu Ile Lys Leu Ala Gly Asp Asn Asn Leu
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Asn Asn Leu Ser Glu Leu Tyr Phe Leu Phe Arg Ile Phe Gly His Pro

420 425 430
 Met Val Asp Glu Arg Gln Ala Met Asp Ser Val Arg Ile Asn Cys Asn
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 Glu Thr Lys Phe Tyr Leu Leu Ser Ser Leu Ser Thr Leu Arg Gly Ala
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 Phe Ile Tyr Arg Ile Ile Lys Gly Phe Val Asn Thr Tyr Asn Arg Trp
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 Pro Thr Leu Arg Asn Ala Ile Val Leu Pro Leu Arg Trp Leu Asn Tyr
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 Tyr Lys Leu Asn Thr Tyr Pro Ser Leu Leu Glu Ile Thr Glu Asn Asp
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 Leu Ile Ile Leu Ser Gly Leu Arg Phe Tyr Arg Glu Phe His Leu Pro
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 Lys Lys Val Asp Leu Glu Met Ile Ile Asn Asp Lys Ala Ile Ser Pro
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 Pro Lys Asp Leu Ile Trp Thr Ser Phe Pro Arg Asn Tyr Met Pro Ser
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 His Ile Gln Asn Tyr Ile Glu His Glu Lys Leu Lys Phe Ser Glu Ser
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 Asp Arg Ser Arg Arg Val Leu Glu Tyr Tyr Leu Arg Asp Asn Lys Phe
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 Asn Ser Asn His Val Val Ser Leu Thr Gly Lys Glu Arg Glu Leu Ser
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 Val Gly Arg Met Phe Ala Met Gln Pro Gly Met Phe Arg Gln Ile Gln
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 Ile Leu Ala Glu Lys Met Ile Ala Glu Asn Ile Leu Gln Phe Phe Pro
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 Glu Ser Leu Thr Arg Tyr Gly Asp Leu Glu Leu Gln Lys Ile Leu Glu
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 Leu Lys Ala Gly Ile Ser Asn Lys Ser Asn Arg Tyr Asn Asp Asn Tyr

675					680					685					
Asn	Asn	Tyr	Ile	Ser	Lys	Cys	Ser	Ile	Ile	Thr	Asp	Leu	Ser	Lys	Phe
690					695					700					
Asn	Gln	Ala	Phe	Arg	Tyr	Glu	Thr	Ser	Cys	Ile	Cys	Ser	Asp	Val	Leu
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Asp	Glu	Leu	His	Gly	Val	Gln	Ser	Leu	Phe	Ser	Trp	Leu	His	Leu	Thr
				725					730					735	
Ile	Pro	Leu	Val	Thr	Ile	Ile	Cys	Thr	Tyr	Arg	His	Ala	Pro	Pro	Phe
			740					745					750		
Ile	Lys	Asp	His	Val	Val	Asn	Leu	Asn	Glu	Val	Asp	Glu	Gln	Ser	Gly
	755					760					765				
Leu	Tyr	Arg	Tyr	His	Met	Gly	Gly	Ile	Glu	Gly	Trp	Cys	Gln	Lys	Leu
	770					775					780				
Trp	Thr	Ile	Glu	Ala	Ile	Ser	Leu	Leu	Asp	Leu	Ile	Ser	Leu	Lys	Gly
785					790					795					800
Lys	Phe	Ser	Ile	Thr	Ala	Leu	Ile	Asn	Gly	Asp	Asn	Gln	Ser	Ile	Asp
				805					810					815	
Ile	Ser	Lys	Pro	Val	Arg	Leu	Ile	Glu	Gly	Gln	Thr	His	Ala	Gln	Ala
			820					825					830		
Asp	Tyr	Leu	Leu	Ala	Leu	Asn	Ser	Leu	Lys	Leu	Leu	Tyr	Lys	Glu	Tyr
	835					840					845				
Ala	Gly	Ile	Gly	His	Lys	Leu	Lys	Gly	Thr	Glu	Thr	Tyr	Ile	Ser	Arg
	850					855					860				
Asp	Met	Gln	Phe	Met	Ser	Lys	Thr	Ile	Gln	His	Asn	Gly	Val	Tyr	Tyr
865					870					875					880
Pro	Ala	Ser	Ile	Lys	Lys	Val	Leu	Arg	Val	Gly	Pro	Trp	Ile	Asn	Thr
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Ile	Leu	Asp	Asp	Phe	Lys	Val	Ser	Leu	Glu	Ser	Ile	Gly	Ser	Leu	Thr
		900						905					910		
Gln	Glu	Leu	Glu	Tyr	Arg	Gly	Glu	Ser	Leu	Leu	Cys	Ser	Leu	Ile	Phe
	915					920					925				
Arg	Asn	Ile	Trp	Leu	Tyr	Asn	Gln	Ile	Ala	Leu	Gln	Leu	Arg	Asn	His

930 935 940
 Ala Leu Cys Asn Asn Lys Leu Tyr Leu Asp Ile Leu Lys Val Leu Lys
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 His Leu Lys Thr Phe Phe Asn Leu Asp Ser Ile Asp Met Ala Leu Ser
 965 970 975
 Leu Tyr Met Asn Leu Pro Met Leu Phe Gly Gly Gly Asp Pro Asn Leu
 980 985 990
 Leu Tyr Arg Ser Phe Tyr Arg Arg Thr Pro Asp Phe Leu Thr Glu Ala
 995 1000 1005
 Ile Val His Ser Val Phe Val Leu Ser Tyr Tyr Thr Gly His Asp Leu
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 Gln Asp Lys Leu Gln Asp Leu Pro Asp Asp Arg Leu Asn Lys Phe Leu
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 Thr Cys Val Ile Thr Phe Asp Lys Asn Pro Asn Ala Glu Phe Val Thr
 1045 1050 1055
 Leu Met Arg Asp Pro Gln Ala Leu Gly Ser Glu Arg Gln Ala Lys Ile
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 Thr Ser Glu Ile Asn Arg Leu Ala Val Thr Glu Val Leu Ser Ile Ala
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 Pro Asn Lys Ile Phe Ser Lys Ser Ala Gln His Tyr Thr Thr Thr Glu
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 Ile Asp Leu Asn Asp Ile Met Gln Asn Ile Glu Pro Thr Tyr Pro His
 1105 1110 1115 1120
 Gly Leu Arg Val Val Tyr Glu Ser Leu Pro Phe Tyr Lys Ala Glu Lys
 1125 1130 1135
 Ile Val Asn Leu Ile Ser Gly Thr Lys Ser Ile Thr Asn Ile Leu Glu
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 Lys Thr Ser Ala Ile Asp Thr Thr Asp Ile Asn Arg Ala Thr Asp Met
 1155 1160 1165
 Met Arg Lys Asn Ile Thr Leu Leu Ile Arg Ile Leu Pro Leu Asp Cys
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 Glu Leu Ser Lys Tyr Val Arg Glu Arg Ser Trp Ser Leu Ser Asn Ile
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 Val Gly Val Thr Ser Pro Ser Ile Met Phe Thr Met Asp Ile Lys Tyr
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 Thr Thr Ser Thr Ile Ala Ser Gly Ile Ile Ile Glu Lys Tyr Asn Val
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 Ser Ser Thr Gln Glu Lys Lys Thr Met Pro Val Tyr Asn Arg Gln Val
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 Leu Thr Lys Lys Gln Arg Asp Gln Ile Asp Leu Leu Ala Lys Leu Asp
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 Ser Thr Gly Thr Leu Gly Leu Ser Tyr Glu Lys Ala Lys Lys Leu Phe
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 Pro Gln Tyr Leu Ser Val Asn Tyr Leu His Arg Leu Thr Val Ser Ser
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 Arg Pro Cys Glu Phe Pro Ala Ser Ile Pro Ala Tyr Arg Thr Thr Asn
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 1395 1400 1405
 Arg Ile Ile Leu Ile Pro Lys Leu Asn Glu Ile His Leu Met Lys Pro
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 Pro Ile Phe Thr Gly Asp Val Asp Ile Ile Lys Leu Lys Gln Val Ile
 1425 1430 1435 1440
 Gln Lys Gln His Met Phe Leu Pro Asp Lys Ile Ser Leu Thr Gln Tyr

1445 1450 1455
 Val Glu Leu Phe Leu Ser Asn Lys Ala Leu Lys Ser Gly Ser His Ile
 1460 1465 1470
 Asn Ser Asn Leu Ile Leu Val His Lys Met Ser Asp Tyr Phe His Asn
 1475 1480 1485
 Ala Tyr Ile Leu Ser Thr Asn Leu Ala Gly His Trp Ile Leu Ile Ile
 1490 1495 1500
 Gln Leu Met Lys Asp Ser Lys Gly Ile Phe Glu Lys Asp Trp Gly Glu
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 Gly Tyr Ile Thr Asp His Met Phe Ile Asn Leu Asn Val Phe Phe Asn
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 Ala Tyr Lys Thr Tyr Leu Leu Cys Phe His Lys Gly Tyr Gly Lys Ala
 1540 1545 1550
 Lys Leu Glu Cys Asp Met Asn Thr Ser Asp Leu Leu Cys Val Leu Glu
 1555 1560 1565
 Leu Ile Asp Ser Ser Tyr Trp Lys Ser Met Ser Lys Val Phe Leu Glu
 1570 1575 1580
 Gln Lys Val Ile Lys Tyr Ile Val Asn Gln Asp Thr Ser Leu Arg Arg
 1585 1590 1595 1600
 Ile Lys Gly Cys His Ser Phe Lys Leu Trp Phe Leu Lys Arg Leu Asp
 1605 1610 1615
 Asn Ala Lys Phe Thr Val Cys Pro Trp Val Val Asn Ile Asp Tyr His
 1620 1625 1630
 Pro Thr His Met Lys Ala Ile Leu Ser Tyr Ile Asp Leu Val Arg Met
 1635 1640 1645
 Gly Leu Ile Asn Val Asp Lys Leu Thr Ile Lys Asn Lys Asn Lys Phe
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 Asn Asp Glu Phe Tyr Thr Ser Asn Leu Phe Tyr Ile Ser Tyr Asn Phe
 1665 1670 1675 1680
 Ser Asp Asn Thr His Leu Leu Thr Lys Gln Ile Arg Ile Ala Asn Ser
 1685 1690 1695
 Glu Leu Glu Asp Asn Tyr Asn Lys Leu Tyr His Pro Thr Pro Glu Thr

1700

1705

1710

Leu Glu Asn Met Ser Leu Ile Pro Val Lys Ser Asn Asn Ser Asn Lys
 1715 1720 1725

Pro Lys Phe Cys Ile Ser Gly Asn Thr Glu Ser Met Met Met Ser Thr
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Phe Ser Ser Lys Met His Ile Lys Ser Ser Thr Val Thr Thr Arg Phe
 1745 1750 1755 1760

Asn Tyr Ser Lys Gln Asp Leu Tyr Asn Leu Phe Pro Ile Val Val Ile
 1765 1770 1775

Asp Lys Ile Ile Asp His Ser Gly Asn Thr Ala Lys Ser Asn Gln Leu
 1780 1785 1790

Tyr Thr Thr Thr Ser His Gln Thr Ser Leu Val Arg Asn Ser Ala Ser
 1795 1800 1805

Leu Tyr Cys Met Leu Pro Trp His His Val Asn Arg Phe Asn Phe Val
 1810 1815 1820

Phe Ser Ser Thr Gly Cys Lys Ile Ser Ile Glu Tyr Ile Leu Lys Asp
 1825 1830 1835 1840

Leu Lys Ile Lys Asp Pro Ser Cys Ile Ala Phe Ile Gly Glu Gly Ala
 1845 1850 1855

Gly Asn Leu Leu Leu Arg Thr Val Val Glu Leu His Pro Asp Ile Arg
 1860 1865 1870

Tyr Ile Tyr Arg Ser Leu Lys Asp Cys Asn Asp His Ser Leu Pro Ile
 1875 1880 1885

Glu Phe Leu Arg Leu Tyr Asn Gly His Ile Asn Ile Asp Tyr Gly Glu
 1890 1895 1900

Asn Leu Thr Ile Pro Ala Thr Asp Ala Thr Asn Asn Ile His Trp Ser
 1905 1910 1915 1920

Tyr Leu His Ile Lys Phe Ala Glu Pro Ile Ser Ile Phe Val Cys Asp
 1925 1930 1935

Ala Glu Leu Pro Val Thr Ala Asn Trp Ser Lys Ile Ile Ile Glu Trp
 1940 1945 1950

Ser Lys His Val Arg Lys Cys Lys Tyr Cys Ser Ser Val Asn Arg Cys

1955

1960

1965

Ile Leu Ile Ala Lys Tyr His Ala Gln Asp Asp Ile Asp Phe Lys Leu
 1970 1975 1980

Asp Asn Ile Thr Ile Leu Lys Thr Tyr Val Cys Leu Gly Ser Lys Leu
 1985 1990 1995 2000

Lys Gly Ser Glu Val Tyr Leu Ile Leu Thr Ile Gly Pro Ala Asn Ile
 2005 2010 2015

Leu Pro Val Phe Asp Val Val Gln Asn Ala Lys Leu Ile Leu Ser Arg
 2020 2025 2030

Thr Lys Asn Phe Ile Met Pro Lys Lys Thr Asp Lys Glu Ser Ile Asp
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Ala Val Ile Lys Ser Leu Ile Pro Phe Leu Cys Tyr Pro Ile Thr Lys
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Lys Gly Ile Lys Thr Ser Leu Ser Lys Leu Lys Ser Val Val Asn Gly
 2065 2070 2075 2080

Asp Ile Leu Ser Tyr Ser Ile Ala Gly Arg Asn Glu Val Phe Ser Asn
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Lys Leu Ile Asn His Lys His Met Asn Ile Leu Lys Trp Leu Asp His
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Val Leu Asn Phe Arg Ser Ala Glu Leu Asn Tyr Asn His Leu Tyr Met
 2115 2120 2125

Ile Glu Ser Thr Tyr Pro Tyr Leu Ser Glu Leu Leu Asn Ser Leu Thr
 2130 2135 2140

Thr Asn Glu Leu Lys Lys Leu Ile Lys Ile Thr Gly Ser Val Leu Tyr
 2145 2150 2155 2160

Asn Leu Pro Asn Glu Gln
 2165